

Part A: Concepts and Patterns

Explain your reasoning. No calculator needed for problems 1 and 2.

1. Earth pulls down on Priya with a gravitational force of 600 N.
 - a. How hard does Priya pull up on Earth? Explain.
 - b. Priya sits 1 m from her friend in class. Why can't she feel the gravitational pull between them, even though every two masses attract?

2. An astronaut weighs 1200 N on Earth's surface, one Earth radius ($1 R$) from Earth's center. Fill in the table to show the gravitational force on the astronaut at each distance from Earth's center. The last row is a different astronaut with twice the mass.

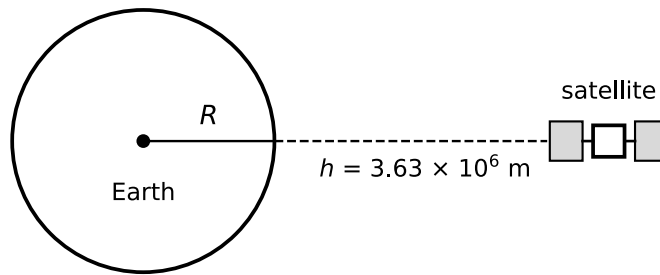
Distance from Earth's center	Gravitational force
$1 R$	1200 N
$2 R$	
$3 R$	
$4 R$	
$3 R$, astronaut with twice the mass	

Part B: Using the Law of Gravitation

Use $F_g = Gm_1m_2/d^2$ with $G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$. Show knowns, equation, substitution, and answer with units.

3. Two boulders on a hillside have masses of $1.2 \times 10^3 \text{ kg}$ and $1.5 \times 10^3 \text{ kg}$. Their centers are 5.0 m apart. What is the gravitational force between them?

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4. A 2.0×10^3 kg weather satellite orbits 3.63×10^6 m above Earth's surface. Earth's mass is 5.97×10^{24} kg and its radius is $R = 6.37 \times 10^6$ m.



- a. What is the distance d from Earth's center to the satellite?
b. What is the gravitational force between Earth and the satellite?

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5. In a lab, a 20.0 kg lead sphere and a 30.0 kg lead sphere attract each other with a force of 1.00×10^{-8} N. How far apart are their centers?

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6. A 75 kg astronaut lands on a planet with a radius of 3.4×10^6 m. On the planet's surface, the planet pulls on her with a force of 277 N. What is the mass of the planet?